

POTENCY OF PHOTOFLASH-PRODUCED RETROGRADE AMNESIA IN  
RATS(U) SCHOOL OF AEROSPACE MEDICINE BROOKS AFB TX  
K R PAGE ET AL JUL 85 USAFSAM-TP-85-1

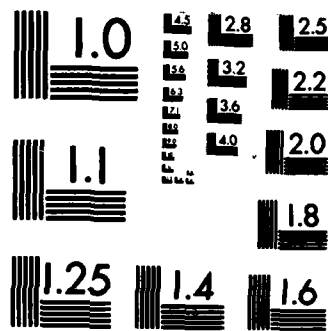
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## POTENCY OF PHOTOFLASH-PRODUCED RETROGRADE AMNESIA IN RATS

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July 1985

Final Technical Paper for Period December 1983 - March 1984

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ELECTED  
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Aerospace Medical Division (AFSC)  
Brooks Air Force Base, TX 78235-5301



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SECURITY CLASSIFICATION OF THIS PAGE

A159149

## REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION Unclassified			1b. RESTRICTIVE MARKINGS											
2a. SECURITY CLASSIFICATION AUTHORITY			3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution is unlimited.											
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE														
4. PERFORMING ORGANIZATION REPORT NUMBER(S) USAFSAM-TP-85-1			5. MONITORING ORGANIZATION REPORT NUMBER(S)											
6a. NAME OF PERFORMING ORGANIZATION USAF School of Aerospace Medicine		6b. OFFICE SYMBOL (If applicable) USAFSAM/RZV		7a. NAME OF MONITORING ORGANIZATION										
6c. ADDRESS (City, State and ZIP Code) Aerospace Medical Division (AFSC) Brooks Air Force Base, TX 78235-5301		7b. ADDRESS (City, State and ZIP Code)												
8a. NAME OF FUNDING/SPONSORING ORGANIZATION USAF School of Aerospace Medicine		8b. OFFICE SYMBOL (If applicable) USAFSAM/RZV		9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER										
8c. ADDRESS (City, State and ZIP Code) Aerospace Medical Division (AFSC) Brooks Air Force Base, TX 78235-5301		10. SOURCE OF FUNDING NOS. <table border="1"><tr><td>PROGRAM ELEMENT NO. 62202F</td><td>PROJECT NO. 7757</td><td>TASK NO. 05</td><td>WORK UNIT NO. 58</td></tr></table>				PROGRAM ELEMENT NO. 62202F	PROJECT NO. 7757	TASK NO. 05	WORK UNIT NO. 58					
PROGRAM ELEMENT NO. 62202F	PROJECT NO. 7757	TASK NO. 05	WORK UNIT NO. 58											
11. TITLE (Include Security Classification) Potency of Photoflash-Produced Retrograde Amnesia in Rats														
12. PERSONAL AUTHOR(S) Page, Karen R., Sergeant, USAF; Wheeler, Thomas G., Ph.D.														
13a. TYPE OF REPORT Final Technical Paper		13b. TIME COVERED FROM Dec 1983 to Mar 1984		14. DATE OF REPORT (Yr., Mo., Day) 1985 July										
15. PAGE COUNT 14														
16. SUPPLEMENTARY NOTATION														
17. COSAT: CODES <table border="1"><tr><th>FIELD</th><th>GROUP</th><th>SUB. GR.</th></tr><tr><td>06</td><td>05</td><td></td></tr><tr><td>05</td><td>10</td><td></td></tr></table>			FIELD	GROUP	SUB. GR.	06	05		05	10		18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number) Retrograde amnesia Shock intensity Memory		
FIELD	GROUP	SUB. GR.												
06	05													
05	10													
19. ABSTRACT (Continue on reverse if necessary and identify by block number) <p>A photoflash has been shown to be an effective amnesiac under certain conditions. The objective of this study was to evaluate the effectiveness of a photoflash in relation to the potency of the preceding event, a foot shock of varying intensities.</p> <p>The task was a single avoidance-trial paradigm. The subject was placed in a small aversive chamber with a door that allowed the subject to enter a large, preferred chamber. Once inside the preferred chamber, the subject received a 1-s foot shock followed by a photoflash. On the avoidance trial, the subject was again placed in the aversive chamber and the time required to enter the preferred chamber was measured. If the photoflash had produced retrograde amnesia (RA), the time required to enter would be small. Retrograde amnesia was demonstrated for the 80-, 85-, and 100-V foot-shock test trials. At 40 V the voltage may not have been great enough to be felt by the subject. For groups examined at shock levels above 100 V, the foot shock was so potent that a photoflash was ineffective in</p>														
20. DISTRIBUTION/AVAILABILITY OF ABSTRACT UNCLASSIFIED/UNLIMITED <input checked="" type="checkbox"/> SAME AS RPT. <input type="checkbox"/> DTIC USERS <input type="checkbox"/>			21. ABSTRACT SECURITY CLASSIFICATION Unclassified											
22a. NAME OF RESPONSIBLE INDIVIDUAL Thomas G. Wheeler, Ph.D.		22b. TELEPHONE NUMBER (Include Area Code) (512) 536-3684		22c. OFFICE SYMBOL USAFSAM/RZV										

## POTENCY OF PHOTOFLASH-PRODUCED RETROGRADE AMNESIA IN RATS

### INTRODUCTION

Recently the photoflash has been shown to produce retrograde amnesia: to interfere with recall of a previously administered foot shock as measured by a single-trial avoidance task (6). The intent of this study was to determine the effectiveness of the photoflash in relation to the intensity of an aversive foot shock, and the disposition these two stimuli hold in terms of the "recency theory" and retrograde amnesia (RA) production.

The recency theory states that if a series of novel stimuli are presented, the subject will most vividly recall the stimulus presented last; most recently (1). In Wheeler's study, an aversive shock was presented 1 s before a photoflash (8), and the animal's ability to recall the shock was a function of photoflash intensity. When the photoflash was presented after termination of the foot shock, the photoflash greatly reduced the animal's adverse reaction to the foot shock. Wheeler's study also demonstrated that the photoflash alone was not an aversive stimulus, whereas a foot shock alone was aversive.

The principal goal of this study was to evaluate the function of foot-shock intensity on the effectiveness of a photoflash to mask a rat's recall of the foot shock.

### METHODS

#### Procedure

The task was a single avoidance-trial paradigm. Animals were placed in a small chamber (A) with a background light of  $50 \mu\text{W}/\text{cm}^2$ . After a 10-s adaptation period, a door opened to provide access to a larger, dark "preferred" chamber (B) (8). The time required for the animal to leave the illuminated chamber and enter the preferred chamber was the measure of interest (denoted as T). Measurement of time began when the door opened and ceased once the animal's hindquarters crossed the threshold. Once inside chamber B, a foot shock of 40, 80, 85, 100, 125, or 135 V (60 Hz, peak-to-peak) was delivered for 1 s (BRS-SGS-001 shocker). An oscilloscope was used to monitor the shock level, and a flash bulb mount (Grass-Photo Stimulator PS22C) was positioned against the outside of the clear wall of chamber B. The photoflash unit was approximately 5 cm from the animal. One second after cessation of the foot shock, the photoflash ( $19 \times 10^6$  lm peak, 10 ms duration) was delivered. Control groups received the foot shock but no photoflash.

A second trial on the task was conducted 1 h after the first trial. Time to enter chamber B on the second trial was recorded as T'. If the animal recalled the shock treatment from trial one, it would hesitate or refuse to leave chamber A (2); the value of T' would be large. If the photoflash had interrupted recall of the foot shock, the T' value would be considerably less. If an animal did not enter chamber B in 100 s, it was returned to its cage and given a score of 100 s.

TABLE 2. SUMMARY OF AVOIDANCE TIME (T'-T) BY FOOT-SHOCK GROUPS

Measure	Photoflash presented	Shock Intensity (V)						
		0*	40	80	85	100	125	135
Mean	Yes	-1.62	8.19	23.02	-0.93	17.27	37.99	66.33
	No	-2.71	7.38	53.66	35.19	55.39	50.24	67.04
SD	Yes	3.30	25.09	14.35	7.12	33.55	37.81	32.33
	No	5.50	22.57	40.28	34.93	43.35	36.59	38.85
SEM	Yes	1.10	6.48	4.54	1.84	8.67	9.79	10.23
	No	1.70	5.83	12.74	9.02	11.19	9.45	12.29
Med	Yes	0.70	0.20	16.75	-5.10	1.40	32.70	75.30
	No	-0.70	-0.50	56.80	42.80	87.00	37.90	84.35
Range	Yes	-11.20	-4.50	6.40	-9.4	-19.20	-16.30	11.80
		to	to	to	to	to	to	to
		0.60	97.70	49.60	18.20	80.40	95.70	97.10
	No	-15.40	-4.60	2.20	-14.30	0.60	6.20	4.10
		to	to	to	to	to	to	to
4.80		86.60	97.20	95.40	97.10	94.90	97.30	

\*Data from Wheeler, 1982 (8).

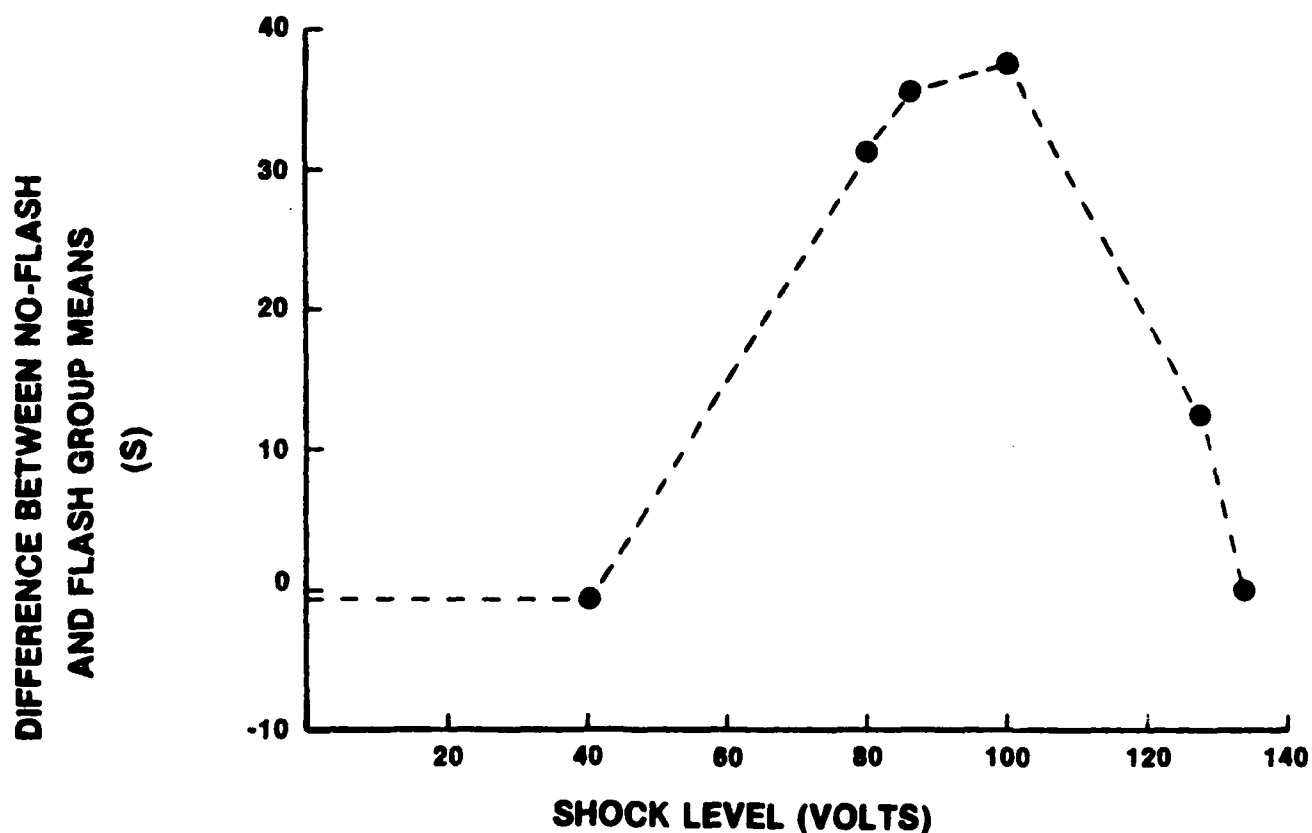


Figure 1. Relative effectiveness of photoflash in producing RA.

## DISCUSSION

The inference made by the recency theory is that if any number of stimuli of any sort are presented in any sequence to a subject, the last stimulus is most likely to be the one recalled. The most recent stimulus is often termed an amnesiac, i.e., it causes retrograde amnesia (RA)--a form of memory loss characterized by inability to recall events preceding the stimulus that caused the memory deficit (5,7,9).

The impact that a stimulus has upon a subject has been referred to as stimulus potency. As long as the stimuli presented to the subject are of equal potency, the recency theory holds true. Once the potency of one stimulus is greater than the other, the more potent stimulus will be remembered; the secondary stimulus is no longer an effective amnesiac. In this study, the potency of the most recent stimulus (photoflash) was held constant while the potency of the foot shock was altered.

The potency of the foot shock might be equated to the trauma it causes the animal to suffer. Lanum et al. (6) studied shock sensitivity in terms of just-detectable vs. adverse shock levels. The just-detectable shock level was found to be .15 mA, and the animal did not make any attempt to actually avoid the shock until the level reached .22 mA. If the animal received a low-level, non-aversive shock (20 and 40 V), the presence or absence of a photoflash would not affect the results.

Figure 1, Relative Effectiveness of Photoflash in Producing RA, illustrates this point. The curve suggests that until the shock experienced by the animal was approximately 60 V, it was not aversive enough to be considered a dependent variable of this study. The photoflash in this study was an effective amnesiac until the foot-shock level became potent enough to override the photoflash effectiveness. The production of RA was apparent in the shock range of 80 to 100 V. It is unclear whether RA occurred or not at 40 V; this shock level may not have been detectable. The potency of the 125- and 135-V stimulus was so great that the second stimulus, the photoflash, was not an effective amnesiac.

# APPENDIX

## AVOIDANCE-TIME REACTION TO FOOT SHOCK

(Time to enter chamber B: T, prior to foot shock in chamber B; T', 1 h after foot shock; T'-T, avoidance time)

<u>With flash</u>					<u>No flash</u>			
Animal No.	T	T'	(T'-T)		Animal No.	T	T	(T'-T)
				<u>40 V</u>				
143	2.3	100.0	97.7		170	3.4	90.0	86.6
150	3.4	13.1	9.7		163	8.2	19.5	11.3
134	4.0	13.1	9.1		183	2.5	13.7	11.2
133	3.1	8.0	4.9		161	2.6	12.6	10.0
140	8.4	13.2	4.8		173	3.0	9.6	6.6
151	2.7	6.9	4.2		174	2.5	4.5	2.0
154	2.7	4.7	2.0		184	2.4	2.8	0.4
130	1.9	2.1	0.2		180	2.4	1.9	-0.5
144	2.1	2.1	0.0		171	2.9	1.9	-1.0
153	2.1	1.9	-0.2		172	5.2	4.2	-1.0
141	4.5	4.1	-0.4		160	4.3	2.2	-2.1
132	3.2	2.3	-0.9		181	3.9	1.8	-2.1
131	3.1	2.0	-1.1		162	4.7	1.9	-2.8
142	5.5	2.8	-2.7		164	5.9	2.6	-3.3
152	6.1	1.6	-4.5		182	5.2	0.6	-4.6
				<u>80 V</u>				
232	7.1	56.7	49.6		140	2.8	100.0	97.2
211	1.6	42.3	40.7		243	3.3	98.6	95.3
231	8.5	40.6	32.1		224	5.4	100.0	94.6
233	4.9	35.5	30.6		241	5.4	97.2	91.8
230	4.9	22.7	17.8		244	5.6	74.9	69.3
210	4.0	19.7	15.7		242	1.8	46.1	44.3
214	1.7	14.8	13.1		222	2.6	24.8	22.2
213	3.4	16.1	12.7		221	8.4	22.3	13.9
212	5.4	16.9	11.5		223	3.9	9.7	5.8
234	3.1	9.5	6.4		220	5.0	7.2	2.2

<u>With flash</u>			
Animal No.	T	T'	(T'-T)

125 V

51	4.3	100.0	95.7
130	10.9	100.0	89.1
102	19.0	100.0	81.0
103	20.6	100.0	79.4
101	36.4	100.0	63.6
20	21.3	82.4	61.1
21	4.0	42.0	38.0
53	6.5	39.2	32.7
23	13.7	36.3	22.6
104	24.8	45.8	21.0
54	6.9	17.5	10.6
100	6.6	9.8	3.2
140	9.7	5.0	-4.7
22	11.6	4.5	-7.1
134	61.1	44.8	-16.3

135 V

62	2.9	100.0	97.1
51	5.7	100.0	94.3
52	6.9	100.0	93.1
63	4.0	94.1	90.1
53	7.2	92.3	85.1
60	2.6	68.1	65.5
54	4.1	64.8	60.7
61	2.5	55.2	52.7
50	4.2	17.1	12.9
64	2.6	14.4	11.8

<u>No flash</u>			
Animal No.	T	T	(T'-T)

93	5.1	100.0	94.9
34	5.7	100.0	94.3
71	6.9	100.0	93.1
94	12.1	100.0	87.9
74	20.0	100.0	80.0
132	21.6	100.0	78.4
91	23.0	100.0	77.0
92	4.9	42.8	37.9
131	4.2	39.1	34.9
73	7.9	32.3	24.4
32	17.8	34.5	16.7
70	3.7	16.1	12.4
30	8.6	16.6	8.0
90	15.2	22.7	7.5
72	16.3	22.5	6.2

40	2.7	100.0	97.3
42	2.9	100.0	97.1
80	3.0	100.0	97.0
44	3.2	100.0	96.8
81	5.2	100.0	94.8
41	4.3	78.2	73.9
43	5.5	79.1	73.6
82	8.4	39.2	30.8
84	2.5	7.5	5.0
83	5.1	9.2	4.1



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